

REMARKS

The rejection of Claims 1, 3-5, 7-12 and 17 under 35 U.S.C. § 103(a) as unpatentable over U.S. 5,726,440 (Kalkhoran et al) in view of U.S. 6,548,338 (Bernstein et al), is respectfully traversed.

The present invention relates to a technique of suppressing so-called "auto doping" when performing an epitaxial growth of a semiconductor substrate.

As described in the specification under "Description of the Background Art," beginning at page 1, line 8, it has conventionally been proposed to form a thin epitaxial layer such as of silicon in a thickness of about several hundreds of nanometers on the surface of a semiconductor substrate such as a silicon substrate, but that impurities, such as boron, contained in the silicon substrate diffuses into the epitaxial layer during epitaxial growth or during a heat treatment, which phenomenon is known as auto doping.

One prior art technique for addressing the auto doping problem, as illustrated in Fig. 5 herein, involves forming an oxide film on the surface of a semiconductor substrate opposite the surface on which the epitaxial layer is to be formed. While this technique suppresses auto doping, it produces noticeable warpage in the resulting semiconductor substrate.

The present invention successfully addresses both the auto doping problem and the warpage problem discussed above.

Kalkhoran et al discloses a wavelength selective photodetector including a substrate, preferably Si-based, having a buried insulator layer, and a photodetection element formed an upper section of the substrate, wherein the insulator layer is preferably fabricated at a selected depth in the substrate and electrically isolates a lower section of the substrate located below the insulator from the upper section of the substrate located above the insulator, wherein the insulator layer may be, for example, silicon oxide or silicon dioxide (column 2, lines 47-59). In all the embodiments shown by Kalkhoran et al, the lower section of the substrate, i.e., 110,

DISCUSSION OF THE AMENDMENT

Claim 1 has been amended by reciting that the oxide film is located at a distance that is closer to the second surface than to the first surface, and that an epitaxial layer is disposed on the first surface, as supported by, for example, Fig. 3, and the disclosure in the specification at page 5, line 8 through page 6, line 7. Claim 2 has been amended into independent form. Claims 5 and 7 have been canceled. Claim 9 has been amended, analogous to Claim 1. Claim 18 has been amended into independent form.

No new matter is believed to have been added by the above amendment. Claims 1-4, 6, 8-12, and 17-18 are now pending in the application.

is relatively thicker than the upper section, i.e., 108 (column 5, line 22ff and Fig. 1, for example). Kalkhoran et al also discloses that the top section 108 can be increased by growing additional Si epitaxially (column 7, lines 1-3). Thus, to the extent Kalkhoran et al discloses the presence of an epitaxial layer, it is on the surface of the substrate that is closest to the insulator layer, i.e., 102, as opposed to above-amended Claim 1 herein, wherein the epitaxial layer is on the surface farthest away from the oxide film.

Bernstein et al discloses a decoupling capacitor and heat sink combination, which is formed on a semiconductor chip, having a buried oxide layer therein (Abstract). However, the so-called buried oxide layer, i.e., 14, is located between a substrate layer 11 and an epitaxial layer 12 (column 3, lines 1-3), and not within the substrate layer 11 itself.

It is not clear why one skilled in the art would combine Kalkhoran et al and Bernstein et al, but if combined, the result would not be the presently-claimed invention. First of all, as discussed above, while Kalkhoran et al's insulator layer is located within their substrate, Bernstein et al's buried oxide layer is adjacent to their substrate. Moreover, Kalkhoran et al and Bernstein et al are drawn to mutually exclusive devices.

For all the above reasons, it is respectfully requested that the rejection over Kalkhoran et al in view of Bernstein et al be withdrawn.

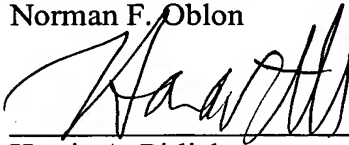
Applicants gratefully acknowledge the Examiner's indication of allowability of Claims 2, 6, and 18. Since Claims 4 and 8 depend, or ultimately depend, on Claim 2, these claims are necessarily allowable as well. Nevertheless, Applicants respectfully submit that all of the presently-pending claims in this application are now in immediate condition for

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allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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